1877MNRAS..38...22D

On the Proper Motions of Groombridge 2275 *and* 2276 (Σ. 1972).

By E. Dunkin, Esq. F.R.S.

The components of this interesting pair of stars, first observed by W. Herschel on 1782, October 12, and afterwards by J. Herschel and South, and W. Struve, under the designation of π' *Ursæ Minoris*, are separated by more than 30″, and according to Struve they are of the sixth and seventh magnitude respectively. There has been some evidence to support the notion that they are physically associated, but little can be gathered in confirmation from the measures hitherto made; on the contrary, the great angular distance between them would rather lead one to suppose that they are seen only optically double. There are, however, several pairs, or groups, of stars forming stellar systems much more widely separated, including some of those recently pointed out by M. Flammarion. Mr. Carrington must have believed in the affinity of these stars, for in his Redhill Catalogue he has inserted a note opposite Groombridge 2276, stating that its place is affected by "proper motion and rotation," to account for an apparent discordance between his resulting R.A. and N.P.D. and that derived from the observations of Professor Schwerd, of Speyer, without, however, giving any authority for the remark. The exact value of the annual proper motions was probably not known to Mr. Carrington, though he had ample data at his command for a fair approximation. It is now found that they are of nearly equal amount—$-0^s\!\cdot\!067$ and $-0^s\!\cdot\!056$ respectively in R.A., and $-0''\!\cdot\!13$ and $-0''\!\cdot\!17$ in N.P.D.; but, considering that the stars are situated only about nine degrees from the Pole, these quantities are not very remarkable. They are, however, of sufficient magnitude to justify their record in the *Monthly Notices*.

I have lately had occasion to verify the mean R.A. and N.P.D. of these stars given in the Greenwich annual star Catalogue for 1875, January 1, by bringing up to the same epoch the R.A. and N.P.D. inserted in the Groombridge and Radcliffe Catalogues. In doing this, my attention was drawn to the large and nearly equal discordances between the computed and the Greenwich Catalogue places, caused evidently by the separate undetermined proper motions of the stars. The discordances both in R.A. and N.P.D. were considerable, amounting to several seconds in each. Both stars were fortunately observed by Lalande on 1790, March 21, and the reduced mean places for January 1 of that year are contained in Fedorenko's Catalogue of his circumpolar stars. The long interval between 1790 and the dates of the modern observations is especially favourable for an accurate determination of the annual proper motion of each star in both elements. It has been considered sufficient for the purpose of our inquiry to confine the comparison of Lalande's places

1877MNRAS..38...22D

with those in the Radcliffe, Redhill, and Greenwich (1875) Catalogues. A separate comparison between the Groombridge and Greenwich places has, however, also been made as a check on the accuracy of the adopted values.

Although it seems premature at present to say that this pair of stars belongs to one stellar system, for the evidence is still insufficient, yet their resulting values of proper motion show conclusively that the two stars are travelling in space in the same direction with an almost equal velocity. The small change in their angular position and distances since the first observations of W. Herschel proves that they are too far separated to have much apparent gravitational effect on each other's movements, but, on the other hand, they appear to be sufficiently near to be mutually influenced by one common law of motion. The discordances between the different early measures of angular distance are greater than one would have expected, or we might probably have been able to give a more definite opinion. More light would, however, be thrown on the separate movements of these two stars if an accurate series of micrometrical measures of their angular position and distance were made at the present time to compare with the former measures. A few more meridional observations of the R.A. and N.P.D. of both stars are also desirable.

The following tabular statement contains the excess of the mean R.A. and N.P.D.—derived from Fedorenko's Lalande by the application of the geometrical precession—over the respective R.A. and N.P.D. printed in the Radcliffe and Redhill Catalogues, and in the annual star catalogue in the *Greenwich Observations* for 1875:—

Catalogue.	Interval between Mean Epochs of Observation.	Excess of R.A. in Catalogues over R.A. from Lalande.		Annual Proper Motion in R.A.	
		G. 2275.	G. 2276.	G. 2275.	G. 2276.
	Years.	s	s	s	s
Radcliffe	60·0	−3·87	−3·29	−0·0645	−0·0548
Redhill	66·2	−4·35	−3·72	−0·0657	−0·0562
Greenwich	85·2	−6·00	−4·73	−0·0704	−0·0555

Catalogue.	Interval between Mean Epochs of Observation.	Excess of N.P.D. in Catalogues over N.P.D. from Lalande.		Annual Proper Motion in N.P.D.	
		G. 2275.	G. 2276.	G. 2275.	G. 2276.
	Years.	″	″	″	″
Radcliffe	55·5	−6·33	−8·41	−0·114	−0·152
Redhill	66·2	−9·69	−13·11	−0·146	−0·198
Greenwich	85·2	−9·95	−13·26	−0·117	−0·156

The means of the annual proper motions resulting from the three comparisons are as follow:—

	Annual Proper Motion In R.A.	Annual Proper Motion In N.P.D.
	s	″
Groombridge 2275	−0·0669	−0·126
,, 2276	−0·0555	−0·169

1877MNRAS..38...24D

These values have been used whenever required; but, as a check on the accuracy of Lalande's places, I have thought it desirable to make an additional comparison by substituting the Groombridge Catalogue for Fedorenko's Lalande. The Groombridge N.P.D. of 2276 is apparently more than four seconds in error, as may be observed below; the proper motion in N.P.D. of this star deduced from this second comparison is therefore too small. The remaining values are almost identical with those determined from the comparison with Lalande. The following are the resulting annual proper motions, using the Groombridge and Greenwich (1875) places only:—

	P.M. in R.A.	P.M. in N.P.D.
	s	″
Groombridge 2275	−0·064	−0·12
„ 2276	−0·055	−0·10

The following differences between the R.A. and N.P.D. of the two stars are taken from the mean places given in the respective catalogues:—

Catalogue.		Δ R.A.	Δ N.P.D.
		s	″
Fedorenko's Lalande	(1790)	12·50	0·0
Groombridge	(1810)	12·66	−5·1
Schwerd	(1828)	12·80	−0·4
Struve	(1830)	12·70	−0·8
Radcliffe	(1845)	12·80	−2·9
Redhill	(1855)	12·80	−4·4
Greenwich	(1875)	12·85	−4·6

Kidbrooke, Blackheath,
1877, *October* 22.

Note on the supposed Physical Association of Groombridge 3477 *and* 3511. By E. Dunkin, Esq. F.R.S.

In M. Flammarion's paper, "Sur un système stellaire en movement propre rapide" (*Comptes Rendus*, No. 8, August 20, 1877), he has exhibited what seems to be a remarkable instance of two stars, separated by more than six minutes of right ascension and nearly ten minutes of polar distance, travelling apparently together in space in the same direction with almost equal proper motions. Assuming that the proper motions employed by him are correct, he concludes that the association of these stars, one of which is a close double, forms a *stellar system* resembling in a great measure the stars 36 *Ophiuchi* and 30 *Scorpii*, which are separated as much as 12′ 21″ in a great circle, but have a common proper motion of some magnitude.